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ACCEPTANCE CRITERIA FOR FORKLIFT TRUCKS

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NEW DELHI 110002

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Indian Standard
ACCEPTANCE CRITERIA FOR FORKLIFT TRUCKS

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(*Continued on page* 2)

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Indian Standard
ACCEPTANCE CRITERIA FOR FORKLIFT TRUCKS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 30 March 1983, after the draft finalized by the Industrial Trucks Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 In the preparation of this standard, assistance has been taken from BS 1727 : 1971 'Specification for motors for battery operated vehicles', issued by the British Standards Institution.

1. SCOPE

1.1 This standard specifies the guidelines on the basis of which forklift truck should be tested.

2. TESTING

2.1 Visual Examination

2.1.1 Each forklift shall be checked for its general workmanship.

2.1.2 It shall be seen that operator's seat is adjustable forward and backward to ensure ease of operation of various controls.

2.1.3 It shall be checked that the control symbols are properly shown in accordance with IS : 7553-1975*.

2.1.4 It shall be checked that the capacity chart is displayed in such a way that it is visible to the operator.

2.2 Dimensional Checks — The following dimensions shall be checked as specified by the manufacturer:

a) Fork length,
b) Maximum forks spread,

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*Control symbols for powered industrial trucks.

- c) Overall length,
- d) Overall width,
- e) Overall height raised,
- f) Collapsed height,
- h) Free lift,
- j) Maximum fork height,
- k) Minimum clearance from ground,
- m) Wheel base,
- n) Tyre size,
- p) Mass of the truck, and
- q) Mast tilt forward and backward.

2.3 Test Certificate — The following shall be accepted on test certificate:

- a) *IC Engine* — As per manufacturer's test certificate in accordance with IS : 10000 (Part XII)-1980*.
- b) *DC Motor* — As per manufacturer's test certificate in accordance with the tests given in Appendix A.
- c) *Battery* — As per manufacturer's test certificate in accordance with IS : 5154-1980†.
- d) *Battery Charger* — As per manufacturer's test certificate.

2.4 Performance Test of Forklift Truck — Each truck shall be tested as follows to ensure satisfactory performance:

- a) *Capacity Test* — The truck shall be driven with rated pay load at the speed specified by the manufacturer.
- b) *Speed Test* — The truck shall be run with/without load at the corresponding speed specified by the manufacturer. The admissible variation in speed shall be within 10 percent.
- c) *Turning Radius* — The truck shall be checked for turning radius. Turning circle radius on both directions shall be checked and it shall be within 5 percent.
- d) *Lifting and Lowering Speed* — Lifting and lowering speed with/without rated load on the trucks shall be checked against the values specified by the manufacturer and shall be within 12 percent.

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*Methods of tests for internal combustion engines: Part XII Test certificate.

†Lead-acid traction batteries (*first revision*).

e) *Gradient Test* — The gradability of the truck shall be such that it can stop and start on specified gradient.

f) *Brake Test* — The service brake performance shall be checked in accordance with Table 1 and the parking brake shall be checked in accordance with **4** of IS : 9701-1980.*

TABLE 1 BRAKE PERFORMANCE

TRUCK SPEED WITH RATED LOAD km/h (1)	REQUIRED DRAWBAR DRAG AS A PERCENT OF GROSS VEHICLE WEIGHT (WITH RATED LOAD) percent (2)	APPROX THEORETICAL DISTANCE AFTER BRAKE STOP FROM FULL SPEED m (3)
2	3·72	0·43
3	5·58	0·64
4	7·44	0·85
5	9·3	1·06
6	11·16	1·27
8	14·88	1·70
10	18·60	2·12
12	22·32	2·54
14	25	3·09
16	25	4·03

NOTE — Maximum pedal effort shall be as prescribed in **2.1.1.1** of IS : 9701-1980*

*Brake performance of powered industrial trucks.

2.5 Stability and Overhead Guard Test

2.5.1 One truck out of twenty trucks supplied by the firm against various orders shall be tested subject to no change in design. The stability tests No. 1, 2, 3 and 4 of IS : 4357-1974† shall be carried out in accordance with conditions laid down in IS : 4357-1974†.

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*Brake performance of powered industrial trucks.

†Methods for stability of forklift truck (*first revision*).

2.5.2 Whenever the overhead guard is introduced or a design change is carried out in the existing of the overhead guard the manufacturer shall test the overhead guard as per IS : 7621-1974*.

2.6 Name Plate Details

a) *Forklift Truck* — The name plate shall be checked to see that it is fitted at suitable place on the truck showing the following details:

   i) Manufacturer's name and registered trade-mark, if any;
   ii) Model;
   iii) Serial number;
   iv) Nomenclature;
   v) Load capacity;
   vi) Year of manufacture;
   vii) Maximum capacity with attachments, if any; and
   viii) Maximum fork height.

b) *Prime Mover* — Details of the prime mover shall be shown as specified below:

In Case of Engine	*In Case of DC Motor*
Manufacturer's name	Manufacturer's name
Model	Model
Serial number	Serial number
Horse power	Horse power
RPM	RPM
	Volt

c) *Instruction Plate* — A suitable instruction plate, indicating precautions during operation and special important procedures to be observed in operating the truck shall be provided in a prominent place on the truck.

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*Tests for overhead guards of powered industrial trucks.

APPENDIX A

[*Clause* 2.3(b)]

TESTING OF DC MOTOR

A-0. The following tests shall be carried out on a DC motor.

A-1. TYPE TESTS

A-1.1 Rated Output Test — The machine shall be tested at all the rated quantities assigned to it by the manufacturer and the results shall comply with the following requirements:

a) When operating under rated quantity conditions on test the temperature rise above the cooling air temperature of parts of machines shall not exceed the values given in Table 2.

TABLE 2 TEMPERATURE RISE

(*Clauses* A-1.1, A-1.4 *and* 2)

PART	METHOD OF MEASUREMENT	TEMPERATURE RISE, °C			
		Nominal Class E Insulation	Nominal Class B Insulation	Nominal Class F Insulation	Nominal Class H Insulation
(1)	(2)	(3)	(4)	(5)	(6)
Armature winding	Resistance	105	120	140	160
Field winding	Resistance	115	130	155	180
Commutator	Electric thermometer	105	115	115	115

Note — The Classes B, E, F and H insulation shall be as prescribed in IS : 1271-1958. Classification of insulating materials for electrical machinery and apparatus in relation to their thermal stability in service.

b) If the actual air temperature during a test lies between 10°C and 40°C no correction is required to the value of temperature rise. If the temperature of the cooling air lies outside these limits special arrangements may be agreed to between the purchaser and the manufacturer.

c) Tests shall be carried out with the motor arranged as in service but not necessarily fitted with gears, and without any cooling corresponding to that produced by the motion of the vehicle. For separately cooled motors each test shall be carried out with the flow of air (in cubic metres per minute) on which the particular rating is based.

d) In the case of self-cooled motors in which the air is drawn through ducting, filters or other parts which may restrict the flow of air in service, tests shall be made, where possible, with such parts in place. Alternatively, for the test, an artificial restriction may be provided at the motor inlet to produce an additional resistance to the flow of air, equivalent to the resistance of such parts when in place. Where air is to be drawn from the interior of the vehicle no account shall be taken of the possible restriction of the entry of air into the vehicle.

e) In the case of machine operating for long periods at altitudes of over 1 000 metres it is necessary to take account of the less efficient cooling compared with that at sea level.

f) The effect of the lower density of air at high altitude depends on the design and construction of the particular machine concerned, but for machines of normal proportions and cooling methods it can be considered that the temperature rise at a given rating will increase by 1 percent for each 100 metres above sea level. Account is not taken of this increase in the case of machines operating at altitudes of under 1 000 metres.

A-1.2 Characteristic Curves and Efficiency Tests — These shall be carried out with the machine windings as near to the appropriate standard temperature of reference as is practicable. Reading shall be taken at a sufficient number of current values to enable the characteristic curves to be verified over the whole range of operation of the machine. For reversible machines, tests shall be carried out in both directions of rotation. The results shall be in accordance with the following:

a) The speed of a motor running in the stated direction of rotation or in either direction of rotation if reversible, shall not deviate from that shown on the characteristic curves by more than the tolerance specified in col 2 of Table 3.

TABLE 3 TOLERANCE ON SPEED

OUTPUT IN kW PER 1 000 REV/MIN AT THE RATED CURRENT	TOLERANCE (PERCENT)	
(1)	(2)	(3)
Below 3	±10	±7½
Not less than 3, but below 10	±7½	±5
10 and above	±6	±4½

b) The tolerances given in col 2 shall not apply to a speed higher than that corresponding to the current at half the declared output or to a speed lower than that corresponding to the current at twice the declared output. Notwithstanding the above, the tolerance permitted at the declared rated current shall not exceed that shown in col 3 of Table 3.

c) If more than one motor is used, than the speed tolerances given in Table 3 may not ensure satisfactory load sharing, in which case closer tolerances shall be agreed to between the purchaser and the manufacturer.

d) The tolerance on the declared efficiency curve at any point between one half and twice the one hour rated current shall not exceed 1/8 (100 — γ) where γ is the declared efficiency expressed as a percentage.

A-1.3 Commutation Tests — These should be carried out at currents corresponding to a number of points selected to cover the full range of operation of the machine, including regenerative and resistive braking conditions where applicable. The result shall be in accordance with the following:

a) Commutation tests shall be made following the temperature tests when the machine is hot and shall be maintained for 30 seconds.

b) A reversible motor shall operate in each direction of rotation with a fixed brush setting throughout the declared range. It shall work without injurious sparking and without injury to the surface of the commutator or to the brushes at any point on the characteristic between the maximum service speed and the maximum current or the current corresponding to the maximum torque in service if this is specified by the purchaser.

c) For a unidirectional motor the standard of commutation in the declared direction shall be as for a reversible motor. In the reverse direction of rotation a lower standard of commutation is permissible but no permanent injury to either commutator or brushes shall be caused by running at half rated voltage at any current between the limiting values used for the normal rotation test.

d) Unidirectional machines which in service cannot operate in the reverse direction shall be tested with normal rotation only.

A-1.4 Overloads Test — Where specified, motors used for propelling the vehicle shall, immediately after completion of the rated output test, be capable of sustaining a 300 percent increase of torque over its rated kilowatt output for a period of 5 minutes. The temperature rise of the motor at the end of the overload test shall not exceed that permitted by the insulation class of the motor in accordance with Table 2.

A-1.5 Overspeed Test — Every motor shall withstand for 2 minutes when hot a rotational speed equal to 1·2 times the maximum service speed.

NOTE — Maximum service speed of a motor is the rotational speed corresponding to the maximum speed met in service which is specified by the purchaser.

A-1.6 Insulation Tests — Insulation tests shall be carried out on all motors at the conclusion of the other tests, including the overspeed test, whilst the machines are still hot. They shall consist of the application of 1 000 V rms for 1 minute between all windings and the frame or core and also between field winding sections when these are separately insulated. The voltage shall be of approximately sinusoidal wave form of any convenient frequency between 25 Hz and 100 Hz and shall be measured on the output side of the testing transformer.

A-1.6.1 The insulation resistance to earth of any combination of components or circuits within the motor should exceed 2 meghoms when tested with a 500 V insulation tester at the conclusion of all other tests.

A-2. ROUTINE TESTS

A-2.1 Soundness and Characteristic — Motors shall be run for sufficient time to attain the temperatures specified in **A-2.1.1** to demonstrate electrical and mechanical soundness. The speed characteristics of motors shall be checked when hot and within the limits given in col 2 of Table 3.

A-2.1.1 The standard temperature of the windings used for plotting declared characteristic curves shall be 75°C when Class E insulation is employed and shall be 110°C for Classes B, F or H insulation.

The characteristic curves shall be plotted at the effective voltage with the value of armature current plotted on the horizontal axis and with the motor speed (rev/min), the output (kW), the motor torque (Nm) and the motor efficiency plotted on the vertical axis.

NOTE — No efficiency measurements are required for routine tests.

A-2.2 Commutation — Each machine shall be tested with minimum field strength at the maximum speed shown on the characteristic, the one hour rated current and the maximum current shown on the characteristic. The result shall be in accordance with **A-1.3**.

A-2.3 Overspeed and Insulation — These shall be carried out in accordance with **A-1.5** and **A-1.6**.

AMENDMENT NO. 1 JULY 1985

TO

IS:10517-1983 ACCEPTANCE CRITERIA FOR FORKLIFT TRUCKS

(*Page 5, clause 2.4*) – Add the following under '*f*' under clause 2.4:

'g) *Fork Testing* – The fork testing shall be carried out in accordance with IS: 6876-1972‡'.

(*Page 5*) – Add the following foot-note at the end of this page:

'‡Technical characteristics and testing of fork arms for forklift trucks'.

(*Page 10, clause A-1.4, line 3*) – Substitute '200 percent' *for* '300 percent'.

(*Page 11, clause A-2.2*) – Substitute the following for the existing clause:

'A-2.2 Commutation – Each machine shall be tested with minimum field strength at the maximum speed shown on the characteristics at the one hour rated current and the maximum current shown on the characteristics for the drive motor. The pump motor shall be tested at the rated current and the maximum current shown on the characteristics for a short term duration as specified by the manufacturer. The result shall be in accordance with A-1.3.'

(MCPD 22)

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